

This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images,
please do not report the images to the
Image Problem Mailbox.**

CLAIMS:

1. A method of forming a silicon dioxide layer, comprising:
forming a high density plasma proximate a substrate;
flowing gases into the plasma, at least some of the gases forming silicon dioxide;
depositing the silicon dioxide formed from the gases over the substrate; and
while depositing the silicon dioxide, maintaining a temperature of the substrate at greater than or equal to about 500° C.
2. The method of claim 1 further comprising:
forming openings in the substrate; and
depositing the silicon dioxide within the openings.
3. The method of claim 1 wherein the gases comprise SiH_4 and oxygen.
4. The method of claim 1 wherein the gases comprise SiH_4 , oxygen and argon.

1 5. A method of forming a silicon dioxide layer, comprising:
2 forming a high density plasma proximate a substrate;
3 flowing gases into the plasma, at least some of the gases forming
4 silicon dioxide;
5 depositing the silicon dioxide formed from the gases over the
6 substrate; and
7 not cooling the substrate with a coolant gas while depositing the
8 silicon dioxide.

9
10 6. The method of claim 5 further comprising maintaining a
11 temperature of the substrate at greater than or equal to 500° C during
12 the depositing.

13
14 7. A method of forming a silicon dioxide layer, comprising:
15 forming a high density plasma proximate a substrate;
16 flowing gases into the plasma, at least some of the gases forming
17 silicon dioxide;
18 depositing the silicon dioxide formed from the gases over the
19 substrate at a deposition rate;
20 while depositing, etching the deposited silicon dioxide with the
21 plasma at an etch rate; and
22 during the etching and depositing, maintaining a temperature of
23 the substrate at greater than or equal to about 500° C.

1 8. The method of claim 7 wherein the gases comprise SiH_4
2 and oxygen.

3
4 9. The method of claim 7 wherein the gases comprise SiH_4 ,
5 oxygen and argon.

6
7 10. The method of claim 7 further comprising:
8 forming openings in the substrate; and
9 depositing the silicon dioxide within the openings.

10
11 11. A method of forming a silicon dioxide layer, comprising:
12 forming a high density plasma proximate a substrate;
13 flowing gases into the plasma, at least some of the gases forming
14 silicon dioxide;

15 depositing the silicon dioxide formed from the gases over the
16 substrate at a deposition rate;

17 while depositing, etching the deposited silicon dioxide with the
18 plasma at an etch rate; and

19 during the etching and depositing, maintaining a temperature of
20 the substrate at greater than or equal to about 500°C , the maintaining
21 a temperature comprising not exposing the substrate to a coolant gas.

1 12. A method of forming a silicon dioxide layer, comprising:
2 forming a high density plasma proximate a substrate;
3 flowing gases into the plasma, at least some of the gases forming
4 silicon dioxide;
5 depositing the silicon dioxide formed from the gases over the
6 substrate at a deposition rate;
7 while depositing, etching the deposited silicon dioxide with the
8 plasma at an etch rate under elevated temperature conditions to achieve
9 a ratio of deposition rate to etch rate that is at least two-times greater
10 than would otherwise occur under identical processing conditions of an
11 identical substrate at lower temperature conditions.
12
13
14
15
16
17
18
19
20
21
22
23
24

1 13. A method of forming a shallow trench isolation region,
2 comprising the following sequential steps:

3 forming openings extending into a substrate, the openings extending
4 less than or equal to about 1 micron into the substrate;

5 heating the substrate in the presence of oxygen to form a first
6 layer of silicon dioxide within the openings; and

7 forming a second layer of silicon dioxide within the openings to
8 fill the openings, the forming the second layer of silicon dioxide
9 comprising:

10 forming a high density plasma proximate the substrate;

11 flowing gases into the plasma, at least some of the gases
12 forming silicon dioxide;

13 maintaining the substrate at a temperature of at least about
14 500° C; and

15 while maintaining the substrate at said temperature,
16 depositing the silicon dioxide formed from the gases within the
17 openings.

18
19 14. The method of claim 13 wherein the gases comprise SiH_4
20 and oxygen.

21
22 15. The method of claim 13 wherein the maintaining the
23 temperature of the substrate comprises heating the substrate with the
24 plasma.

1 16. The method of claim 13 wherein the silicon dioxide is
2 deposited at a deposition rate, and further comprising etching the
3 deposited silicon dioxide with the plasma at an etch rate, a ratio of the
4 deposition rate to the etch rate being at least about 4:1.

5
6 17. The method of claim 13 wherein the ratio of the deposition
- rate to the etch rate is at least about 6:1.

8
9 18. The method of claim 13 wherein the ratio of the deposition
10 rate to the etch rate is at least about 9:1.

11
12 19. A method of forming a silicon dioxide layer, comprising:
13 forming a high density plasma proximate a substrate, the plasma
14 comprising silicon dioxide precursors, the substrate comprising an opening
15 having an aspect ratio of at least about 1;

16 forming silicon dioxide from the precursors, the silicon dioxide
17 being deposited within the opening at a deposition rate; and

18 while depositing, etching the silicon dioxide deposited within the
19 opening, the etching comprising etching with the plasma at an etch rate;
20 a ratio of the deposition rate to the etch rate being at least about 4:1.

21
22 20. The method of claim 19 wherein the opening has an aspect
23 ratio of from about 2.5 to about 1.

1 21. The method of claim 19 further comprising:
2 placing the substrate in a reaction chamber, the reaction chamber
3 comprising inductive coils to generate the plasma; the depositing and
4 etching occurring in the reaction chamber;
5 providing a first bias to the inductive coils; and
6 during the etching, providing a second bias to the substrate.

7
8 22. A method of forming a silicon dioxide layer, comprising:
9 forming a high density plasma proximate a substrate, the substrate
10 comprising an opening having an aspect ratio of at least about 1;
11 flowing gases into the plasma, at least some of the gases forming
12 silicon dioxide;
13 depositing the silicon dioxide formed from the gases within the
14 opening at a deposition rate; and
15 while depositing, etching the silicon dioxide deposited within the
16 opening with the plasma at an etch rate; a ratio of the deposition rate
17 to the etch rate being at least about 4:1.

18
19 23. The method of claim 22 wherein the opening has an aspect
20 ratio of from about 2.5 to about 1.

21
22 24. The method of claim 22 wherein the ratio of the deposition
23 rate to the etch rate is at least about 6:1.
24

1 25. The method of claim 22 wherein the ratio of the deposition
2 rate to the etch rate is at least about 9:1.

3
4 26. The method of claim 22 further comprising maintaining a
5 temperature of the substrate at greater than or equal to about 500° C
6 during the deposition and etching.

7
8 27. The method of claim 22 further comprising:
9 forming openings in the substrate; and
10 depositing the silicon dioxide within the openings.

11
12 28. The method of claim 22 wherein the gases comprise SiH_4
13 and oxygen.

14
15 29. The method of claim 22 wherein the gases comprise SiH_4 ,
16 oxygen and argon.

17
18 30. The method of claim 22 wherein the gases are a mixture
19 consisting essentially of SiH_4 , oxygen and argon.

1 31. A method of forming a silicon dioxide layer, comprising:
2 forming a high density plasma proximate a substrate, the substrate
3 comprising a step;
4 flowing gases into the plasma, at least some of the gases forming
5 silicon dioxide;
6 depositing the silicon dioxide formed from the gases over the
7 substrate step; and
8 while depositing the silicon dioxide, maintaining a temperature of
9 the substrate at greater than or equal to about 500° C, the depositing
10 achieving better step coverage than would otherwise occur at lower
11 temperatures.

12
13 32. The method of claim 31 further comprising:
14 forming openings in the substrate; and
15 depositing the silicon dioxide within the openings.

16
17 33. The method of claim 31 wherein the gases comprise SiH_4
18 and oxygen.

19
20 34. The method of claim 31 wherein the gases comprise SiH_4 ,
21 oxygen and argon.
22
23
24

1 35. A method of forming a shallow trench isolation region,
2 comprising the following sequential steps:

3 forming openings extending into a substrate, the openings extending
4 less than or equal to about 1 micron into the substrate, the substrate
5 comprising steps at peripheries of the openings;

6 heating the substrate in the presence of oxygen to form a first
7 layer of silicon dioxide within the openings; and

8 forming a second layer of silicon dioxide within the openings to
9 fill the openings, the forming the second layer of silicon dioxide
10 comprising:

11 forming a high density plasma proximate the substrate;

12 flowing gases into the plasma, at least some of the gases
13 forming silicon dioxide;

14 maintaining the substrate at a temperature of at least about
15 500° C; and

16 while maintaining the substrate at said temperature,
17 depositing the silicon dioxide formed from the gases within the
18 openings and over the steps, the depositing achieving better step
19 coverage than would otherwise occur at lower temperatures.
20

21 36. The method of claim 35 wherein the gases comprise SiH₄
22 and oxygen.
23
24

37. The method of claim 35 wherein the maintaining the temperature of the substrate comprises heating the substrate with the plasma.

38. The method of claim 35 wherein the silicon dioxide is deposited at a deposition rate, and further comprising etching the deposited silicon dioxide with the plasma at an etch rate, a ratio of the deposition rate to the etch rate being at least about 4:1.

39. The method of claim 35 wherein the ratio of the deposition rate to the etch rate is at least about 6:1.

40. The method of claim 35 wherein the ratio of the deposition rate to the etch rate is at least about 9:1.